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Dr. G. S. Buchanan's Report to the Local Government Board
upon Epidemic Diphtheria in the Borough of Tunbridge
Wells.

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RICH^D. THORNE THORNE,
Medical Officer,
March 9th, 1899.

At the end of April 1898, the Returns of the Registrar General showed that in the Borough of Tunbridge Wells as many as 13 deaths from diphtheria had been recorded during the first three months of the year. As no information had been received from the Medical Officer of Health of this borough that diphtheria was prevalent in his district, the Board requested the Town Council to instruct that officer to furnish a report upon the subject.

The Medical Officer of Health, Dr. Stamford, reporting accordingly on May 25th, informed the Board that during the three months in question he had learnt, by means of "notification," of 101 cases of diphtheria occurring within the borough. Little indication of the conditions under which diphtheria had become epidemic was to be had from Dr. Stamford's report, but the measures in repression of the outbreak adopted by the Town Council were stated in some detail, and in general it was to be gathered from the report that diphtheria had ceased to be prevalent in the district. At the end of July, however, the Registrar General's Returns recorded nine additional deaths from diphtheria in the Borough of Tunbridge Wells between April 1st and June 30th, and, no further communication having been received from the Town Council or Medical Officer of Health, the Board directed local inquiry. Accordingly I visited Tunbridge Wells in the middle of August and again at the end of September.

Before dealing with the diphtheria prevalence, it will be convenient if I give a brief general description of Tunbridge Wells and of its sanitary condition and administration.

I.—GENERAL DESCRIPTION AND SANITARY CONDITION.

The Borough of Tunbridge Wells is situate in West Kent, and has an area of 3,740 acres. Most of this area consists of hills and plateaux of Tunbridge Wells Sand, a dry and porous stratum of the Hastings series. In the northern part of the borough patches of Weald Clay overlie the Tunbridge Wells Sand, and near its eastern boundary Wadhurst Clay, another stratum of the Hastings series, crops out from beneath the sand. Much of the area of the borough is occupied by open heathy common and by public and private parks and gardens. A large proportion of the inhabitants are persons of the well-to-do class; many have business in London, or have settled in Tunbridge Wells after retirement from work; others, again, are persons who spend a large portion of the year at Tunbridge Wells in pursuit of health. There are several large hotels, and many householders let lodgings to visitors during a summer or a winter "season." The shops, workshops, and places of business are those incidental to a residential neighbourhood and health resort. The poorer class are for the most part

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artisans or labourers employed within Tunbridge Wells : only few find occupation in agriculture outside the borough.

At the census of 1891, there were in the borough 27,895 persons. Although each year since 1891 the birth rate of Tunbridge Wells has been comparatively low, there has been considerable migration to the district, and the Medical Officer of Health estimates the population in 1898 at about 30,000. The rateable value of the borough at the end of 1897 was £236,400 ; that assessable for the general district rate was £229,180.

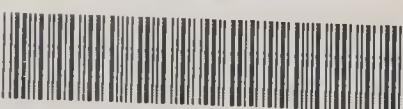
Dwellings.—The total number of inhabited houses in 1891 was 5,230. Each year since 1891, about 100 new dwellings, almost entirely houses with six or more rooms, have been erected within the borough. The total of inhabited houses is now, the Surveyor informs me, about 5,900. Except in one or two of the older parts of the town, such as "Harvey's Town," dwellings are rarely crowded upon area, and there are scarcely any closed courts. Overcrowding of persons in dwellings, however, appears to be not uncommon. The four room or six room cottages of the place are often occupied jointly by two or more families, partly because the rents of such houses are high—they are rarely below 7/- a week—and also because dwelling accommodation for the working class population of the town is inadequate.

Dwellings in Tunbridge Wells are for the most part built of local brick, faced with concrete. Some are of sandstone, and a few of the older dwellings are of wood. Smaller houses and villas, some of comparatively recent date among the number, not seldom seem unsubstantially built : only in a few instances, however, did I notice serious dilapidations in external walls or roofs. Until recent years houses have usually been built without damp-proof course, but, except where they are erected upon clay soil, their walls are seldom noticeably damp. The majority of dwellings have gardens attached to them. On much of the cottage property, however, there are small unpaved yards but no gardens, and in such yards it is common for poultry, rabbits, and other animals to be kept, often, it is said, in such a manner as to cause nuisance.

House drainage is in many instances objectionable. Thus, house drains are rarely trapped from the sewer, and frequently they are ventilated only by means of rain-water pipes which open just below the eaves. Often, I was informed, waste pipes opening within the dwelling are connected directly with the house drain. The house drains of new dwellings, however, appear usually to be well-contrived. Within the smaller dwellings, commonly the only drain is a sink-pipe, which discharges its contents outside the building over a bell trap. These bell traps are usually defective. Sometimes inefficient stonemason's traps have been provided.

Excrement Disposal is almost everywhere effected by means of water-closets. In houses of better class are occasionally found water-closets provided with objectionable "D-traps," and soil pipes of water-closets often are unventilated. As a rule in smaller house property, each dwelling has belonging to it a water-closet, usually placed outside the building. A majority of these water-closets are without apparatus for flushing ; being of the "hopper" type, and getting merely an occasional "flush" from a water can, they often become filthy. In one row of houses I found closets of this sort built in the basement of the house, opening into the kitchen.

Sewerage.—In some of the older parts of the town, as the Pantiles and London Road, are large brick barrel sewers of some antiquity. The greater part of the borough was sewered from 40 to 50 years ago. The sewers then laid were principally unglazed earthenware pipes, uncemented at their junctions. Recently several new sewers of good construction have been laid in new streets, and others have been provided in place of older sewers. Almost everywhere the sewers have a good fall, and for many of them artificial flushing is rarely necessary. In places where manhole covers were removed for my inspection, I saw no silting. Ventilation of some of the older sewers is effected by shafts opening at fixed gratings in the centre of the roadway. At varying intervals over other sewers are manholes with ventilating covers. As has been indicated, rain-water pipes of dwellings not unfrequently act as sewer ventilators. Certain branch sewers have neither manholes nor ventilating openings at their "dead ends." At many points in the borough, within the last few years, sewers have been provided with ventilating shafts which are



carried up by the side of buildings or are erected lamp-post fashion by the side of the road. Where a sewer has been provided with a shaft of this sort a number of ventilating openings in the roadway have been closed.

In many streets the drains of several adjoining houses unite to form a common drain, which runs at the back of the dwellings to ultimately reach a sewer in the roadway. Where such common drains have been excavated they have often been found irregularly laid and leaking.

There are two main outfall sewers in the borough ; the first, which serves the southern half of the town, delivers its contents by gravitation to a broad irrigation area of 199 acres near Groombridge acquired in 1868 for the purpose. Sewage from a collection of dwellings at Denny Bottom and from certain houses on Mount Ephraim is conveyed into this southern outfall sewer by pumping. The dry-weather flow of sewage at the southern outfall is estimated at 600,000 gallons a day.

The second outfall sewer, serving the northern half of the town, and carrying in dry weather some 400,000 gallons a day, has its outfall at Great Lodge, about 2 miles to the north of Tunbridge Wells. Here there are now 187 acres upon which sewage is treated by broad irrigation. Recently this main outfall sewer has been reconstructed, and 60 acres of land have been added to the northern sewage farm.

Refuse disposal.—Most houses have brick dustbins. Frequently these receptacles are uncovered and their floors are not watertight. In other instances however householders have provided movable galvanized iron receptacles. The Town Council employ a staff of 25 scavengers, who are said to complete a round of the district every 9 days in winter, and once a week in summer. The collected refuse is tipped into a large clay pit in the Southborough Urban District.

The *Water Works* of the borough, which belong to the Town Council and yield a constant supply, are situate at Pembury, in the rural district of Tonbridge. They comprise a pumping station and a storage reservoir of 42 million gallons capacity, supplied partly from deep wells, and partly from springs in the neighbourhood. These springs are fed by surface water which has percolated through varying thicknesses of Tunbridge Wells Sand and has reached the underlying Wadhurst Clay. The land which they drain is for the most part unfrequented woodland ; two of the springs however appear to receive the drainage of agricultural land. I was informed that objection has been taken to the use of water from certain of the springs, on account of their proximity to the villages of Lower Green and Matfield Green. The former village is situated some 600 yards from and at a higher level than "Batchelor's" spring, and the latter is similarly situated with regard to "Collins'" spring. Both villages are built upon Tunbridge Wells Sand, and have cesspools or privy pits sunk into the same formation. Having regard to the levels and geological conditions hereabouts, risk of pollution from cesspools or privy pits in these villages seems remote ; nevertheless it would be too much to assert that there is no appreciable risk of contamination from these sources. Opportunities of pollution of "Collins' spring" appear to be afforded by a privy pit at a farm house about 100 yards from, and at higher level than the spring. The springs are in each instance enclosed in covered brick chambers, and their water is led to the reservoir in pipes. The deep wells which constitute the other source of supply are close by the reservoir and have been sunk through Tunbridge Wells Sand and Wadhurst Clay into Ashdown Sand. Water derived from these wells contains a notable amount of iron in solution. During the summer of this year, the supply of spring water failed, and little else than deep well water was received in the reservoir. It has not however been necessary to intermit the supply. Two additional deep wells are now being sunk in the neighbourhood of the waterworks, and the Town Council have under consideration a proposal that all water from the storage reservoir shall pass through filter beds before being distributed in the town.

Milk Supply.—Most milk is brought in from outside the borough. The cowsheds which I inspected in Tunbridge Wells appeared to conform to the borough regulations. The arrangements of certain of the milk shops in the town left little to be desired. In certain other milk shops, however, I found milk kept in badly paved cellars, lighted and ventilated only by a small grating opening on to the footway.

Several *Bakehouses* in the borough which I visited appeared well constructed and cleanly kept ; one which was dirty and objectionable was, it was said, about to be reconstructed.

Certain registered *Slaughterhouses* in the place are old buildings ill adapted for the purpose, being badly paved and lighted, and lacking a convenient supply of water.

II. SANITARY ADMINISTRATION.

Prior to 1889 sanitary administration was in the hands of the Local Board of Tunbridge Wells, who were Commissioners under the Tunbridge Wells Improvement Act of 1846. The area administered by the Local Board was, without alteration of boundary, constituted a Borough in 1889.

The Town Council consists of 33 members, nine of whom constitute a "Health Committee," which meets fortnightly. The Medical Officer of Health, Dr. W. Stamford, who is in medical practice in the town, was appointed to the office in 1881 and receives a salary of £180, half of which is repaid from county funds. The Inspector of Nuisances, Mr. J. Cave, receives a salary of £160, half of which is similarly repaid. An assistant inspector was appointed by the Town Council in November 1897, and a second assistant inspector in February of this year.

A new Tunbridge Wells Improvement Act, containing several important sanitary provisions, received Royal Assent in 1890. It contains clauses similar to those of the Infectious Disease (Prevention) Act of 1890. The Infectious Disease (Notification) Act was adopted by the Town Council in 1889 ; the whole of the Public Health Acts Amendment Act has also been adopted. No bye-laws have been made under the latter Act. There are bye-laws as to Slaughter Houses and Public Baths. The borough bye-laws as to New Streets and Buildings are a series adopted by the Local Board in 1869 : they are in several respects antiquated, and are insufficient for the purpose. Additional powers as to new streets and buildings have however been conferred upon the Town Council in clauses of the Improvement Act of 1890. For the most part bye-laws and local Act set out general powers possessed by the Town Council in matters of house construction, house drainage, and the like, without specifying definite requirements upon these points. To meet difficulty which has arisen from want of definition in respect of drainage of new buildings, the Town Council have recently at the instance of the Inspector of Nuisances formulated, as they consider they have power to do under their Act, a series of "Drainage Regulations," which embody most of the drainage requirements set out in the Board's Model Code.

Such facts as I learnt about the sanitary history of Tunbridge Wells seemed to show that the Local Board which preceded the Town Council had indeed executed certain important works, notably of water supply and sewerage ; but that in certain respects administration in later years had become conspicuously lax in matters of import to the public health of the town. Thus, reports of the Medical Officer of Health for several years prior to 1890 do not indicate that the numerous sanitary shortcomings of the place had often been brought to the notice of or had received attention from the Local Board. No systematic inspection of the district appears to have been made by officers of the sanitary department, and inspection of nuisances on receipt of complaint seems to have usually been a perfunctory proceeding. New buildings and new private drains, I was informed, were often neither supervised in construction nor properly examined on completion. Since sanitary administration has been in the hands of the Town Council greater activity has been displayed. Particular works undertaken since 1890 have been the acquisition of a public recreation ground, building public baths, laying a new outfall sewer and adding to the western sewage farm. As has been said, improvements in the public water service are now in progress. A good isolation hospital was erected in 1895, under loan sanctioned by the Local Government Board, upon seven acres of land at Frant Forest, in the rural district of Ticehurst. This hospital comprises administration and laundry blocks ; a block of two wards, each constructed for ten beds ; and a second block of two wards each constructed for two beds. There is also an old building in which additional accommodation for patients might be found in

emergency. A good ambulance is kept at the hospital, and a steam disinfecting apparatus has been provided. The Medical Officer of Health is also Medical Superintendent of the hospital.

Day-to-day administration has improved since the appointment of the present Inspector of Nuisances four years ago. This officer, who is hard working and capable, has been at pains to draw the attention of the Town Council to numerous sanitary shortcomings, such as defective drains, unpaved yards, closets without flushing apparatus, overcrowding, and the like. In many instances the Town Council have taken action with a view to improvement. Once a beginning had been made in detecting and remedying defects of this sort, they soon came to demand attention in increasing number: indeed, at the date of my inspection, I was informed that there were so many premises in respect of which notice had been given to remedy faulty conditions, that local builders could not keep pace with demands upon them. I visited several premises on which improvements had recently been effected at the instance of the Town Council. Upon the whole, it appeared that requirements specified by the Inspector of Nuisances had been sufficient, and that the necessary works had been executed in satisfactory fashion. Since assistance has been given to him, this officer has been able to arrange a system of house-to-house inspection, which has been carried out in certain quarters of the town.

Certain dwellings have lately been condemned by the Town Council as being unfit for human habitation, but owing to the lack of houses suitable to the labouring class, difficulty has been met with in finding dwelling accommodation for persons displaced. Similar difficulty has arisen in dealing with overcrowding of persons in the district. The Town Council have now provisionally accepted a scheme recommended to them by the Medical Officer of Health for erecting a block of workmen's dwellings under the provisions of Part III. of the Housing of the Working Classes Act, and have purchased land in the north of Tunbridge Wells for the purpose.

On reviewing the recent history of the borough, it must be conceded that recent action by the Town Council indicates commendable determination to rectify an abundance of sanitary defects which have been allowed to accumulate in their district. It is evident, however, that there are still numerous shortcomings which will continue to demand from them careful attention and sustained effort.

III.—DIPHTHERIA PREVALENCE.

With regard to the extent of diphtheria prevalence in Tunbridge Wells in years prior to 1898, indication was to be had from mortality returns as follows :—

TABLE A.—ANNUAL MORTALITY FROM DIPHTHERIA (INCLUDING MEMBRANOUS CROUP) PER 10,000 LIVING, AT ALL AGES*.

Years.	Borough of Tunbridge Wells	England and Wales.	Kent.
Ten years 1881–90			
1891	2·12	1·63	2·32
1892	1·43	1·74	1·25
1893	2·87	2·26	2·54
1894	3·58	3·26	4·45
1895	2·15	3·03	3·96
1896	2·51	2·72	3·25
1897	3·23	3·04	5·64
	3·94	2·57	4·25

* For 1881–90, the Tunbridge Wells rate is here calculated upon a mean of the census populations of 1881 and 1891; the England and Wales rate and the Kent rate are taken from the decennial supplement of the Registrar-General. The remaining rates are, in each instance, calculated upon the population at the 1891 census.

From this table it appears that from 1881 to 1897 the rate of mortality from diphtheria in Tunbridge Wells has in general not conspicuously exceeded the rate for the whole of England and Wales, and has, for the most part, been somewhat below the rate for the county of Kent. Deductions from these rates must, however, be made with caution, in view of the distribution of the population of Tunbridge Wells in respect of age. Per 1,000 of the total population at the 1891

census, the proportion of children under five (the quinquennial age-period at which the fatality from diphtheria is greatest) was in England and Wales 122, in Kent 120, and in the borough of Tunbridge Wells only 98. Similarly, from 1892 to 1896 the average of the annual birth rates in the borough per 1,000 of population has been 21·6, in contrast with an average rate of 30·2 in England and Wales and of 26·8 in Kent.

In 1898, I learnt, a total of 30 deaths from diphtheria had occurred within the borough between January 1st and the end of September. For these nine months the diphtheria death rate, per 10,000 living at all ages at the 1891 census, had thus been 10·8. During the same period, the total number of persons known to the Medical Officer of Health as having been attacked by diphtheria was 251. All these cases he had heard of by means of notification returns. The 251 cases had occurred in a total of 167 dwellings. The number of cases notified week by week is shown in table B; the distribution of cases in respect of age and fatal result in table C.

TABLE B.

Week ending	Number of Cases of Diphtheria notified to Medical Officer of Health.	Number of Dwellings notified as newly invaded by Diphtheria each week.	Week ending		Number of Cases of Diphtheria notified to Medical Officer of Health.	Number of Dwellings notified as newly invaded by Diphtheria each week.
			June	July		
January	5	4	1		8	4
	12	2	1		15	3
	19	...	...		22	2
	26	...	...		29	2
February	2	1	1		6	2
	9	8	4		13	4
	16	8	6		20	2
	23	35	22		27	11
March	2	17	10		3	9
	9	10	5		10	5
	16	6	4		17	9
	23	5	4		24	6
April	30	12	6		31	6
	6	11	6		7	4
	13	9	5		14	1
	20	3	2		21	3
May	27	8	8		28	1
	4	4	3		Whole period January 1 to end of September.	
	11	9	6		251	167
	18	8	4			
June	25	10	8			
	1	7	6			

TABLE C.

	Ages.				Age not ascertained.	Total.
	0—5.	5—15.	15—25.	25 and upwards.		
Number of cases notified between January 1 and end of September, 1898.	64	133	23	24	7	251
Of which were fatal	...	...	12	18	...	30

Having regard to the population of Tunbridge Wells and to its previous diphtheria records, it may be concluded from the figures of table B that, during the whole of eight months, from February to the end of September, diphtheria in the borough assumed epidemic proportions. At the beginning of the epidemic, in the latter three weeks of February and in the early days of March, there was an outbreak in which some 78 cases of diphtheria were notified, and some 47 dwellings invaded by the disease.

On inquiry as to the situation of the invaded houses, both throughout the epidemic and during the February outbreak, I ascertained that in each instance there had been an altogether exceptional incidence of diphtheria upon dwellings in the north-eastern part of the town. These dwellings were situate within an area roughly half a mile square, comprising about a quarter of the populous part of Tunbridge Wells, and a large proportion of the smaller dwellings of the place. Except that it includes "Shatters Wood," the boundaries of this area correspond very nearly to those of the East Ward of the borough, and it may accordingly be termed the East Ward area. From a series of "spot-maps" prepared for me by the Inspector of Nuisances, I ascertained that during six weeks prior to February 9th, a total of seven houses had been notified as invaded by diphtheria, of which six were in East Ward area ; and that 42 out of 47 additional dwellings notified as invaded between February 10th and March 15th were within the same area. From the middle of March onwards to September, East Ward area continued to suffer in excess of the rest of the borough. The spot-maps gave me particulars of 93 houses newly attacked by diphtheria between March 16th and August 22nd, and of these, 68 were within, and 25 outside the East Ward area. It seemed necessary therefore, to inquire more particularly for conditions which throughout the epidemic had conduced to infection within the East Ward area, and which had particularly operated within this area during the period of outbreak.

First as to the operation of infection from *person to person*. At no time throughout the epidemic, I learnt, had inquiries been made with a view to referring each newly notified case of diphtheria to infection from some antecedently occurring case or cases. Indications were not wanting, however, that in this instance, as commonly in other diphtheria outbreaks, the principal factor in the spread of the disease had been exposure to personal infection.

Thus there had been numerous instances in which members of an invaded household had suffered diphtheria one or more weeks after the first occurrence of the disease in their dwelling ; at least a third of the 251 notified cases had occurred in dwellings from which a case of diphtheria had been previously and recently notified. That members of an infected household had in some cases communicated infection to members of neighbouring households was suggested by several instances in which every one of a group of adjoining dwellings possessing a yard or garden used as a common playground by children became invaded in the course of the epidemic.

With reference to particular opportunities of personal infection which might have afforded explanation of the outbreak of February, I learnt that with six exceptions, all the 78 persons notified as attacked by diphtheria between February 3rd and March 9th were children at ages between 3 and 15. Apart from question of school attendance, no considerable number of these children had, so far as I could ascertain, been brought together during the period ; their dwellings were not confined to a few particular streets, but were scattered all over the East Ward area. As to school attendance, the facts were as follows :—There are two public elementary schools which between them serve the East Ward area, and derive almost all their scholars from this area. These schools, named St. Barnabas and St. James respectively, are situate in the centre of East Ward. In each instance they are of recent construction. St. Barnabas school is designed to accommodate 743 scholars, and St. James' school 516. Each school has girls', boys', and infants' department, and a distinct playground. But the boundaries of the two schools are separated merely by the breadth of the Camden Road ; children attending one school, I was informed, habitually play with children of the other just outside the school premises or on the way to and from school ; while in a large number of households certain of the children attend St. Barnabas' while others attend St. James'. It was thus hardly to be expected that if diphtheria had been spread in this area by intercourse of school children, the disease would have manifested itself among children of one school and not among children of the other.

From search of the school registers, I obtained particulars of the attendance at school of the children who suffered from diphtheria in the earlier months of the epidemic. They may be summarised as follows :—

TABLE D.

Week ending	Total Cases of Diphtheria notified.	Of which were Children attending St. James' and St. Barnabas' Schools up to, or within a few days of, the date of notification.	Total Dwellings notified as newly-invaded by Diphtheria.	Number of these Dwellings from which a Child or Children habitually attended St. James' or St. Barnabas' Schools.	Number of these Dwellings in which the first notified Case of Diphtheria was a Child attending St. James' or St. Barnabas' School up to, or within a few days of, the date of notification.
January 5	4	[Both Schools opened January 10.]	1	1	[Both Schools opened January 10.]
12	2		1	...	
19	...	...	...	...	...
26	...	...	...	...	...
February 2	1	...	1	...	...
9	8	6 } *	4	4	4
16	8	3 }	6	3	3
23	35	26 } †	22	22	17
March 2	17	8 }	10	9	5
9	10	[Both Schools closed February 21.]	5	3	[Both Schools closed February 21.]
16	6	Schools opened : St. Barnabas, Mar. 21.	4	3	Schools opened : St. Barnabas, Mar. 21.
23	5	St. James', Mar. 28.]	4	2	St. James', Mar. 28.]
30	12	4 }	6	5	2
April 6	11	2 } †	6	2	2

* All St. Barnabas.

† 14 St. Barnabas.

‡ 5 St. Barnabas.

It appeared from the figures above given that nearly all the houses known to have been invaded during the period of outbreak, February 3 to March 9, were dwellings from which one or more children were attending St. James' or St. Barnabas' School ; that after these schools were closed (at the instance of the Medical Officer of Health) on February 21st, the weekly number of houses newly invaded began to diminish ; and that after March 28th, at which date both schools had been reopened, there was a slight increase in the weekly number of newly invaded houses. As regards children actually attending school immediately antecedent to illness, it appeared that prior to, and for about a week after, the date of closing the schools, such children formed a majority of the total cases notified, and further that in a large proportion of dwellings invaded during this period, the first case to be notified was a child who was attending or who had just ceased attending one or other of these schools.

The information at my disposal was insufficient to indicate whether, after the first five or six weeks of the epidemic attendance at these schools had operated to maintain the prevalent diphtheria. St. Barnabas School was open (save for a few days at Easter and at Whitsuntide) from March 21st to August 17th ; St. James' School was similarly open from March 28th to August 12th. Up to April 6th the incidence of disease, as shown by notifications, upon the scholars has been shown in Table D. From April 7th to August 17th, 81 dwellings in the borough were notified as newly invaded, and in 31 of these, St. James' or St. Barnabas' School was attended by one or more children in the household. During the same period, children attending certain other public elementary schools and certain private schools in the borough were attacked by diphtheria, but in no case in such large numbers as to call for comment.

As to opportunities of infection in Sunday schools, I learnt that within East Ward area a large number of children attend the two Sunday schools of St. James and St. Barnabas, and that these Sunday schools were closed during approximately the same period in February and March as the day schools. Particulars of attendance at Sunday school of children who were attacked by diphtheria had not been sought, and, as I was informed that nearly every

Sunday school child in East Ward area was also an attendant at St. James' or St. Barnabas' day school, it seemed unlikely that, at the date of my inquiry, useful information could be had by searching the Sunday school registers. One teacher in St. James' Sunday School was attacked by diphtheria in July.

At the date of my visit in August I made inquiry as to eight cases of diphtheria, occurring in six dwellings, which had most recently been notified to the Medical Officer of Health. History of exposure to infection from antecedently occurring cases was to be had in some instances. Thus in one dwelling in East Ward a previous case of diphtheria, in a child attending St. James' School, had recently occurred ; in each of two other invaded houses in East Ward I ascertained that the child attacked had two or three days before onset of illness been playing with a companion who, about a fortnight previously, had been notified to be suffering from diphtheria. In a fourth case, the dwelling, outside East Ward, was a house of good class, sublet to a family of visitors, two of whom fell ill with diphtheria upon the same date. Up to this date a servant in the house had several times each week been visiting a relative in Aukland Road, in the East Ward. Several cases of diphtheria had recently occurred in dwellings close by this relative's house, and the servant, whom I saw, had large and inflamed tonsils, and stated that she had suffered from cold and slight sore throat for some days antecedent to the illness of the visitors.

Inquiry as to *milk* had been made in each of the notified cases. The results showed that both during the period of outbreak of February and March and throughout the epidemic the milk consumed by the sufferers shortly before onset of their illness had been derived from a large number of retailers, who in turn had been supplied from several separate farms. And at no time during the epidemic had excessive incidence of diphtheria upon the customers of any one dairy been observed. As usual in the case of diphtheria epidemics, there was no evidence to suggest that the supply of *drinking water* had operated to produce infection.

I obtained no indication that emanations from *sewers*, or from defective house drains, could be thought of as having operated as direct causative agents in the production of the epidemic. The sewers of East Ward are in direct relation with the main outfall sewer which passes to the north sewage farm. This outfall sewer also receives the sewage of North Ward, in which scarcely any cases of diphtheria occurred. Within the East Ward area the distribution of invaded houses did not appear to correspond to the distribution of particular branch sewers ; nor, so far as I could ascertain, were those streets in which were situate the greatest number of invaded houses at exceptional disadvantage in the matter of defective sewers or of emanations from sewer ventilators. Defects in house drainage, faulty traps, foul water closets and the like, were common enough in East Ward area, but on the whole dwellings in this area could not be deemed worse in this respect than dwellings of similar class in other parts of the borough. Moreover, a not inconsiderable proportion of the invaded houses had recently been provided with satisfactory drains, traps, and water-closets before any case of diphtheria occurred in them. But that defects of sewerage and house drainage, and other sanitary shortcomings contributed indirectly to the epidemic by rendering persons more liable to contract diphtheria on exposure to infection I am by no means in position to deny. Similarly, it is not impossible that the progress of the epidemic may have been remotely favoured by disturbance of foul soil which took place during this year in the neighbourhood of a large number of dwellings in East Ward.

A view, favoured by the Medical Officer of Health, attributed share in the production of the epidemic to inhalation of dust from the roadways. Owing to the dry summer the Town Council considered it expedient to lessen the demand on their water service by ceasing to water the roads. Hence dust accumulated and gave rise to nuisance—often intensified by “dry sweeping” performed by the Town Council’s scavengers. But seeing that this dust nuisance was general throughout the town, and by no means confined to East Ward, its relation, if any, to the diphtheria prevalence, must be considered remote.

It should be recorded that the practice is very common among inhabitants of East Ward of keeping fowls, pigeons, and rabbits, in the small back yards or

gardens belonging to their dwellings. The Inspector of Nuisances informed me that, in visiting houses recently invaded by diphtheria, he had on several occasions heard of illness or deaths among fowls and rabbits—animals which would seem liable to diphtheria or allied malady. No recently occurring cases of the sort were to be heard of at the dates of my visit.

IV.—MEASURES ADOPTED IN REPRESSION OF THE DIPHTHERIA EPIDEMIC.

On receipt by the Medical Officer of Health of notification of the existence of diphtheria in a dwelling, Dr. Stamford informed the Inspector of Nuisances, who, usually within 24 hours, visited the invaded house, made certain inquiries, and left a handbill containing a series of "suggestions" for the prevention of epidemic disease which had been drawn up by the Medical Officer of Health. In most cases carbolic soap was supplied to those attending the diphtheria patient; also cotton wool, which could be used for receiving discharges and then burnt. Injunctions were given that all children in the house should be kept from school. Notices to the effect that persons in the dwelling were suffering from infectious illness were sent to the school authorities and to public libraries. Printed letter-cards, addressed to the Medical Officer of Health, were supplied to medical men in the town upon which to certify when, in their opinion, diphtheria patients in their care had ceased to be infectious. On receipt of one of these letter cards the premises were again visited; the room or rooms occupied by the diphtheria patient were fumigated with sulphur, and a notice to the effect that the dwelling might now be considered free from infection was sent to public libraries and to school authorities. As to isolation of infectious cases, I learnt that, in a large majority of instances, the diphtheria patient had been treated at home under such conditions of isolation as were advised by his medical attendant, and could be complied with by those in charge of the patient. As a general rule, isolation in the borough hospital had been offered only in those cases where a request for hospital isolation had been made to the Medical Officer of Health by the patient's medical attendant.

This routine of dealing with notified diphtheria cases appears to have been systematically followed. The Medical Officer of Health rarely visited the invaded dwellings, or took steps to ascertain at first hand the sufficiency of provision made for the isolation of sick at their homes, and the observance of other matters enjoined in his circular of "suggestions"; for the reason that, being also in general practice, he deemed it desirable to be chary in visiting dwellings in which medical practitioners were attending patients. Too rigid an adherence to the custom of not visiting invaded dwellings, however, had this disadvantage, that Dr. Stamford was hardly ever in a position to know of the existence of cases of diphtheria in which the illness was so slight that medical advice was not sought, or of cases in which the clinical manifestations were so indefinite that the medical practitioner had not been in position to make a definite diagnosis of diphtheria.

In course of inquiry at invaded houses I learnt in several instances of sore throat or other illness, occurring at or about the time when diphtheria declared itself, among members of the family other than those notified to be suffering from diphtheria. Similarly, in at least two invaded dwellings which I visited, I ascertained that there had been frequent opportunities of intercourse between the children of the house and children of a neighbouring dwelling; and, on visiting the latter dwelling, from which no case of diphtheria had been notified, I found that one or more of the inmates were said to have recently suffered from sore throat, as to which no medical man had been consulted.

As regards schools, the two schools which no doubt had some considerable share in enhancing the outbreak in February, were closed on February 21st, at the instance of the Medical Officer of Health, and Sunday-school authorities were advised to close St. James' and St. Barnabas' Sunday-schools about the same date. Before re-opening certain precautions were taken in both schools; slates were washed with disinfectant solution, and the class-rooms thoroughly cleansed. On re-opening the schools at the end of March, school teachers were advised of the desirability of preventing licking of slates and pencils, sharing sweets, and other customs of children considered likely to spread infection. In a few

instances where a child came to school obviously ill the opinion of the Medical Officer of Health was sought by the school authorities. But no routine inquiry was made at either school for cases of indisposition among the children actually in attendance. The co-operation of the school attendance officer, who, if instructions had been given him, might have obtained useful and early information as to children staying away from school on account of illness, was not obtained.

The use of the *isolation hospital* for diphtheria was, as has been said, restricted to comparatively few cases. I learnt that during the outbreak in February and March—the period during which prompt isolation in hospital might have availed greatly to prevent the spread of diphtheria—only a single diphtheria patient was received in hospital : up to the date of my visit in August, a total of 25 diphtheria cases had been admitted to hospital since the beginning of the year. There could be no doubt that diphtheria patients were not seldom treated at their homes under conditions which rendered isolation almost impossible. I was informed of instances in which the room occupied by the sufferer was used by other members of the household, and having regard to the frequency with which small houses in East Ward are shared between two families or otherwise become overcrowded, occurrences of the sort can hardly have been uncommon. Whether, as was alleged to me, the hospital was little used because parents were unwilling to send children there, or were dissuaded from sending them by their medical adviser, or whether, on the other hand, the hospital would have been much more freely used if the Town Council had offered hospital isolation in each case, I am unable to say. Throughout the epidemic there was accommodation at the borough isolation hospital for diphtheria patients in considerably larger number than those actually received.

The *disinfection* practised consisted, as has been said, in sulphur fumigation of the room which had been occupied by the diphtheria patient. Clothing, bedding, and other articles which had been used in the sick room were left in the room during the fumigation. The steam disinfecting apparatus at the hospital was this year used for the disinfection of articles from scarlet-fever patients, but not for those of diphtheria patients—a distinction which it would not seem easy to justify.

Other precautionary measures taken during the outbreak were the closure, during the early part of the year only, of certain drinking fountains in the borough, and the occasional flushing of sewers in the infected area. At the date of my visit, the Town Council had recently authorised the Medical Officer of Health to obtain and supply diphtheria anti-toxin to medical practitioners for use in cases where it might reasonably be furnished at public expense.

G. S. BUCHANAN.

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